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THORNDIKE'S LEGACY: LEARNING, SELECTION, AND THE LAW OF EFFECT

A. CHARLES CATANIA

UNIVERSITY OF MARYLAND BALTIMORE COUNTY

This introduction to a symposium on the centennial of Edward L. Thorndike's 1898 monograph on animal intelligence briefly considers the origins of his law of effect and the influence of Darwin's selectionism. It also provides the background for an unfinished book review by William W. Cumming of a biography of Thorndike. The review places in historical context Thorndike's position both on psychology as a science of behavior and on the vocabulary of that science.

Key words: E. L. Thorndike, *Animal Intelligence* monograph, law of effect, learning theories, associationism, Charles Darwin, selectionism

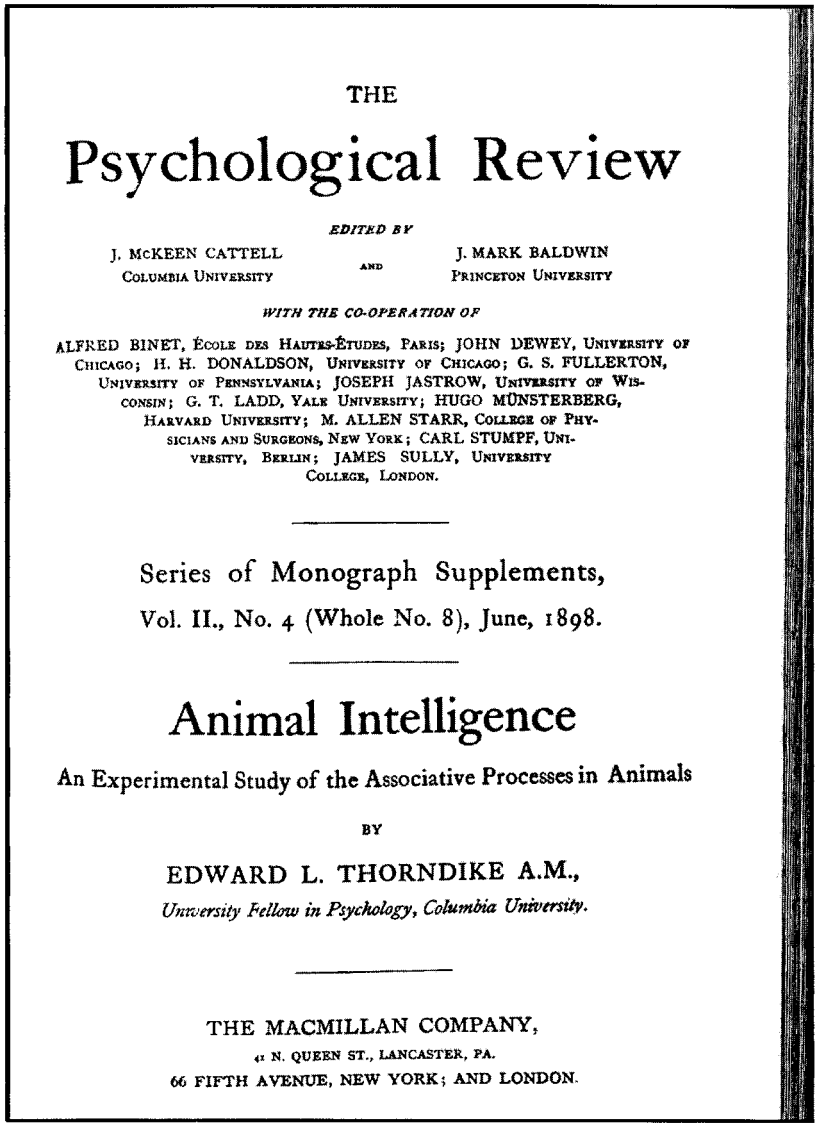
A symposium celebrating the centennial of Thorndike's monograph, *Animal Intelligence* (Thorndike, 1898) was held in San Francisco on Saturday, August 15, 1998, at the annual meeting of the American Psychological Association. We shared our celebration with others who recognized the significance of the anniversary: This journal published a commemorative review by Lattal (1998), and the *American Psychologist* devoted a special section to Thorndike at about the same time (Dewsbury, 1998).

All four original participants in the symposium have contributed their papers to this special section of the *Journal of the Experimental Analysis of Behavior* (*JEAB*) dedicated to Thorndike's seminal work. The symposium included Paul Chance's discussion of Thorndike's experiments with puzzle boxes and other research reported in the monograph, Eliot Hearst's summary of Thorndike's later contributions to psychology, John A. Nevin's treatment of some implications of stimulus–response bonds, and John W. Donahoe's selectionist account of Thorndike's legacy. Our symposium was conceived and organized by Raymond C. Pitts, cochair of the Division 25 Program Committee, who graciously asked me to serve as chair rather than chairing the symposium himself. That invitation gave me the opportunity to include a posthumous participant, William W. Cumming, whose contribution took the form of excerpts from a book review of a Thorndike biography that he did not live to complete.

The monograph celebrated by this symposium has been a focus of discussion not only for its substantive content but also for its proper citation. Lattal (1992) points out the great variability in the ways it has been cited. The issue is particularly important because monograph supplements are not always bound in with the regular volumes of the journals of which they are a part and therefore may be difficult to locate even when they are in a library collection. Following Lattal's lead, let us therefore set that part of the record straight. Identical text appears on the speckled gray front cover and on the first inside page. As shown in Figure 1, the heading at the top reads *The Psychological Review.* An editorial listing indicates that the journal is edited by James McKeen Cattell of Columbia University and J. Mark Baldwin of Princeton University, ''with the co-operation of'' 10 others. The citation information then follows, with the publisher's name and address appearing at the bottom of the title page. The back cover gives some information about *The Psychological Review* and *The Psychological Index,* and then lists two volumes, each consisting of four monographs. Thorndike's is listed as number VIII in Volume II: ''Animal Intelligence: Edward L. Thorndike. Pp. ii + 109. $1.00.'' Subscription information appears at the bottom of the page.

One topic that will be touched on by more than one presentation is the dating of the origin of Thorndike's law of effect. The law is certainly implicit in the 1898 monograph. The name came later, but in its early uses it

For reprints, write to A. Charles Catania, Department of Psychology, University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, Maryland 21250 (E-mail: catania@umbc.edu).



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Animal Intelligence

An Experimental Study of the Associative Processes in Animals

BY

EDWARD L. THORNDIKE A.M.,

University Fellow in Psychology, Columbia University.

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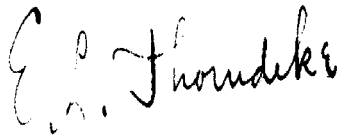

Fig. 1. The cover page of Thorndike's 1898 *Animal Intelligence* monograph. This page is reproduced from a custom-bound volume of Thorndike's that included a copy of his own monograph together with reprints of works by C. Lloyd Morgan, Willard S. Small, John B. Watson, and others. Thorndike's signature from the front of the volume appears below the cover page.

was applied to inferred neural changes rather than to changes in behavior. For example, consider the following (Thorndike, 1907, p. 166):

> Stating the law in terms of connections made between cells, we could say: *Connections between neurons are strengthened every time they are used with indifferent or pleasurable results and weakened every time they are used with resulting discomfort.* This law includes the action of two factors, frequency and pleasurable result. It might be

> stated in a compound form as follows. (1) *The line of least resistance is, other things being equal, that resulting in the greatest satisfaction to the animal*; and (2) *the line of least resistance is, other things being equal, that oftenest traversed by the nervous impulse*. We may call (1) the *Law of Effect* and (2) the *Law of Habit*.

Our conclusions about date of origin will depend on whether we are interested in the word *effect* or its definition, and on whether we count definitions in terms of physiology as equivalent to those in terms of behavior. It should be evident that Thorndike's verbal behavior was itself a product of selection, and it is often difficult to place a date on the origin of an evolved or evolving form.

It is fitting to place this symposium and Thorndike's law in the context of a discussion of evolution by selection, because Thorndike's position was Darwinian from the start. The following is from Thorndike's *The Human Nature Club*, written only a short time after the publication of his monograph: ''The method of learning by the selection of successes from among a lot of acts is the most fundamental method of learning'' (Thorndike, 1901, p. 38). Even then, Thorndike meant selection by the consequences and not selection by the organism (in speaking of selection, it is crucial to specify what gets selected and what does the selecting).

> The gradual increase in success means a gradual strengthening of one set of nerve-connections, and a gradual weakening of others. This method of learning may be called the method of trial and error, or of trial and success. . . . The cause of such strengthening and weakening is the resulting pleasure in one case and discomfort in the others. (Thorndike, 1901, pp. 38–39)

In the later book version of his monograph, Thorndike treated learning itself as a product of selection:

> The most important of all original abilities is the ability to learn. It, like other capacities, has evolved. The animal series shows a development from animals whose connection-system suffers little or no permanent modification to animals whose connections are in large measure created by use and disuse, satisfaction and discomfort. (Thorndike, 1911, p. 278)

It has been suggested that Thorndike was more of a Darwinian early in his career than later (Jonçich, 1968). Whether or not that was the case, Thorndike wrote about Darwin and evolution (Thorndike, 1909) at a time when Darwinian selection still seemed to be in jeopardy as a legitimate account of the mechanism of evolution. Those involved in the dispute acknowledged evolution, but at issue was whether it was a product of natural selection (Catania, 1987). In this context, it may be of interest that the role of selection by consequences received explicit treatment only relatively late in Skinner's work, roughly half a century after Thorndike had virtually begun his career by treating learning in terms of selection (Catania, 1995; Skinner, 1953).

Now let us turn to the participant whose name did not appear on the program. Early during my editorship of the *JEAB* book reviews, I received a letter from H. S. Terrace. The letter said that Bill Cumming had suggested the review in *JEAB* of a biography of Thorndike by Geraldine Jonçich (1968). The letter went on to suggest that Cumming be invited to write that review (H. S. Terrace, personal communication, January 22, 1969). I extended the invitation and Bill Cumming accepted it, but he did not live to complete the review. He died early in 1970. His family made the working manuscript available, and I forwarded it to Bill's colleague, John A. Nevin, after having discussed with him the possibility of finishing the review: ''I enclose the materials for Bill Cumming's projected review. . . . I have made a photocopy, if it should be that we can find some way to complete the review. But there is so much still to be done that I can't feel optimistic'' (A. C. Catania, personal communication, April 28, 1970).

Cumming's working manuscript included multiple revisions of early sections, miscellaneous brief sections in both typed and handwritten form, and various odd notes and references. There was not enough to show how Cumming planned to continue and end the review, and we eventually dropped the project. But much of what Cumming had finished was about Thorndike's monograph and his law of effect, which had taken up only a chapter or so in the biography. When Ray Pitts invited me to chair this symposium, that provided a perfect opportunity to make Bill Cumming's unfinished work available, because the papers of the other participants

would extend to the material that he had not covered and therefore would at last provide closure.

At the 1998 symposium, I read and commented on only a few passages from the manuscript, so as not to constrain the time available to the other participants. Here it is possible to allow William W. Cumming's unfinished *JEAB* review of Jonçich's (1968) biography of Thorndike to speak for itself. Although what follows has waited roughly 30 years for publication, the writing still seems fresh. From what was, we can guess at what might have been.

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